

NEW SPECIES AND A NEW GENUS OF THE SUBFAMILY POGONINAE FROM SOUTH AUSTRALIA (COLEOPTERA: CARABIDAE)

M. BAEHR & P. HUDSON

BAEHR, M. & HUDSON, P. 2001. New species and a new genus of the subfamily Pogoninae from South Australia (Coleoptera: Carabidae). *Records of the South Australian Museum* 34(1): 1–18.

A new genus and species, *Syrdenoidius spinipes* gen. nov., sp. nov., and three new species of the genus *Pogonus* Dejean from salt lakes in South Australia are described: *Pogonus matthewsi*, *P. vicinus*, and *P. perovalis*. The first two species are closely related to *P. grossi* Moore from Lake Eyre and *P. saskiae* Baehr from Lake Gairdner and Island Lagoon and together they form a complex of four very closely related species. *Pogonus perovalis* sp. nov. is outstanding in its body shape and absence of wings, but may be remotely related to this complex. The new genus *Syrdenoidius* is highly similar in shape and structure to the Palearctic genus *Syrdenus* Chaudoir, though it differs mainly in the asetose prosternum, the markedly spinose tibiae, the absence of wings, and a very unusual female stylomere 2. *Syrdenoidius spinipes* sp. nov. and *Pogonus perovalis* sp. nov. are outstanding in their absence of wings and loss of flying ability, attributes that are extremely rare within Pogoninae. Most of the new species were collected by excavation of their burrows on the lake surface, or by pitfall trapping.

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INTRODUCTION

Most halophile pogonine species occupy habitats such as seashores and inland salt lakes and most are strong fliers that readily come to lights. Such habitats have been favoured collecting localities in other parts of the world for a very long time and there is a general belief that the taxonomy of the subfamily is well known. Nevertheless, several new species have been recently described throughout the world (Kryzhanovskij & Michailov 1971, Morvan 1973, Kryzhanovskij 1990, Bousquet & Laplante 1997, Baehr & Sciaky (in press), Hudson 2000). At present, there are 11 pogonine genera worldwide containing about 78 taxa. *Pogonus* s. str. is by far the most speciose genus with 49 described taxa (Lorenz 1998).

In Australia, the number of described pogonines was surprisingly low for a very long time (Chaudoir 1871, 1878; Sloane 1895). Moore (1977) described new species from Lake Eyre and since then a number of additional species have been detected and described (Baehr 1984, 1997, 1999; Moore 1991, Hudson 2000) resulting in a total of 12 species of *Pogonus* known from Australia. It is now evident that all parts of

Australia suitable for pogonines are colonised by at least one or another species. The salt lake belt from interior Western Australia through the southern half of South Australia to northwestern Victoria (and probably westernmost New South Wales) is the stronghold of pogonines in Australia, with many closely related but also some unusual species occurring there.

Four new species are described herein, including a representative of an unusual new genus. Although the pogonine fauna of Australia comprises predominantly the genus *Pogonus* s. str., it is one of the most speciose in the world with high morphological diversity and includes some very strangely shaped species.

The majority of the Australian pogonines are depigmented, many are extremely elongate and depressed ('syrdeniform'), characters which are evidence of an obligatory nocturnal and at the same time psammophile life. Apart from this, very little is known about habits, ecological preferences, and life histories of most of the Australian pogonine species, since most collections have been made using light traps. It is the scope of this paper, among other things, to increase ecological information about the Australian pogonines.

The present paper was prepared when the senior author (MB) worked through the unidentified carabid material in the South Australian Museum, Adelaide, and separated a number of pogonine specimens that turned out to belong to undescribed species. They had been mostly collected by the junior author (PH) during his ample collecting work on salt lakes throughout South Australia. Personal contact between MB and PH during MB's stay at the Museum revealed that PH had a number of additional, freshly caught specimens that were subsequently sent to MB for identification. Since PH has collected many taxa using pitfall traps and by excavation of burrows, both authors agreed to collaborate in a joint paper, with MB mainly responsible for the taxonomic section, and PH for the ecological part. Authorship of the new taxa is in joint names. Some records of known species from the SAMA collection and those made by MB during a recent collecting trip through northwestern Victoria and southern South Australia are also included, in cases where they enlarge the known range or add any other information.

MEASUREMENTS

Measurements were taken using a stereo microscope with an ocular micrometer. Length has been measured from apical margin of labrum to apex of elytra; measurements, therefore, may slightly differ from those of other authors. Length of pronotum was taken at the longest distance

(which is not always along midline!), and width between the posterior lateral angles.

LOCATION OF MATERIAL

The holotypes of the new species are located in the South Australian Museum, Adelaide (SAMA), paratypes of all species are kept in the working collection of the senior author (CBM) at the Zoologische Staatssammlung München. Paratypes of *Syrdenoidius spinipes* are also kept in the Australian National Insect Collection, Canberra (ANIC).

TAXONOMIC PRINCIPLES

Whereas one of the three new taxa of the genus *Pogonus* is very specialised in shape and structure and certainly merits full specific status, two taxa belong to a group of depigmented, elongate, depressed, syrdeniform species that so far include *Pogonus grossi* Moore and *P. saskiae* Baehr from saline inland habitats in South Australia. The four taxa now known to exist in this group are very similar and certainly they are closely related. They have been collected at four different localities throughout the salt lake belt of South Australia, and could be either subspecies of one widespread species, or closely related species. We have decided to rank them as species rather than subspecies for two reasons. Firstly there appear to be consistent, though minor differences, between them (see Tables 1 and 2). Secondly there are heuristic

TABLE 1. Some distinguishing characters within the *Pogonus grossi*-group

	<i>grossi</i> (L. Eyre)	<i>vicinus</i> (L. Frome)	<i>matthewsi</i> (Pernatty Lag.)	<i>saskiae</i> (Island Lag.)
body size	large	large	large	small
pronotum	wide	wide	wide	narrow
basal angle	slightly excised	not excised	not excised	excised
basal angle	not dentiform	dentiform	dentiform	not dentiform
lateral margin	evenly convex	rather straight	evenly convex	evenly convex
		anteriorly convex		
lateral margin	widest behind	widest in front	widest at	widest at
	anterior third	of anterior third	anterior third	anterior third
elytra	rather depressed	rather depressed	convex	depressed
intervals	slightly convex	slightly convex	strongly convex	slightly convex
striae	distinctly punctate	barely punctate	distinctly punctate	distinctly punctate
striae	rather deeply impressed	rather shallow	deeply impressed	rather deeply impressed
microreticulation	distinct	distinct	very distinct	distinct

TABLE 2. Summary of measurements and ratios for all species of the *Pogonus grossi*-group. For better recognition of the species the measurements and ratios for all species of the *P. grossi*-group are compiled in the following table.

	body length (mm)	ratio width/length pronotum	ratio width base/apex pronotum	ratio width pronotum/head	ratio length/width elytra	ratio width elytra/pronotum
<i>grossi</i>	5.2–6.4	1.18–1.21	0.91–0.93	1.13–1.15	1.85–1.91	1.27–1.35
<i>vicinus</i>	5.1–6.0	1.13–1.16	0.98–1.01	1.16–1.21	1.72–1.77	1.30–1.34
<i>matthewsi</i>	5.6–6.2	1.15–1.17	0.96–1.02	1.12–1.16	1.86–1.90	1.26–1.28
<i>saskiae</i> *	4.65–4.90(4.15)	1.07–1.11(1.21)	0.87–0.88(0.85)	1.03–1.10(1.12)	1.96–1.98(1.90)	1.29–1.40

* In *Pogonus saskiae* Baehr one extraordinary small specimen has some rather different proportions of pronotum and elytra (see Baehr 1997) that are added in brackets.

reasons for doing so since definition of subspecies is more difficult than that of species and would require more information about gene flow or hybrid zones. Further investigations should show which concept is better applicable to this difficult group.

TAXONOMY

There is no need for an extensive characterization of the subfamily Pogoninae (or tribe Pogonini, according to the preferred system). A list of synonymies including the most important citations, and an extensive diagnosis of the subfamily was recently given by Bousquet and Laplante (1997) that should be used by readers who want to receive more general information about the group. A summary of the presently known genera and species has been recently provided by Lorenz (1998). More information about the Australian *Pogonus* species can be obtained from Moore (1977), and the subsequent descriptions of additional species by Moore (1991), Baehr (1984, 1997, 1999), and Hudson (2000).

ADDITIONAL RECORDS OF DESCRIBED SPECIES

Pogonus grossi Moore

Moore 1977: 63; Moore *et al.* 1987: 146; Baehr 1997: 3; 1999: 147.

This species is only known from the type locality Lake Eyre (Moore *et al.* 1987). In the SAMA collection there is a large series of specimens from Madigan Gulf and Prescott Gulf (both Lake Eyre North). Thus, *P. grossi* seems to have colonised a large part of the shores of this lake.

Pogonus hypharpagioides Sloane

(Fig. 1)

Sloane 1895: 126; Moore 1977: 63; Moore *et al.* 1987: 146; Baehr 1997: 2, 3; 1999: 147.

In addition to its type locality, Lake Callabonna, *P. hypharpagioides* has previously been recorded from Lake Eyre (Moore *et al.* 1987) and Lake Frome (Baehr 1997). Collections made by the authors show this species is widely distributed throughout the salt lake belt from northwestern Victoria to the west coast of South Australia, including some near-coastal localities (see Fig. 1). A variety of techniques have been employed in collecting this species; many specimens were excavated from burrows, others were collected at light, in pitfall traps or while running on the surface at night.

Pogonus variabilis Moore

Moore 1991: 31; Baehr 1997: 2; 1999: 147.

In the collection of SAMA there is a series of specimens caught by N. B. Tindale and P. Aitken in 1963 at Normanton and on Mornington Island, both northwestern Queensland, that apparently escaped the attention of Moore when he described this species in 1991. They are evidence of the wide range of this species along the coasts of tropical Australia. Characteristically, they have been collected at light.

DESCRIPTIONS OF NEW SPECIES

Pogonus matthewsi sp. nov.

(Figs 2, 5, 8, 19)

Types

Holotype: male, P. Hudson. 3 Sept. 1996,

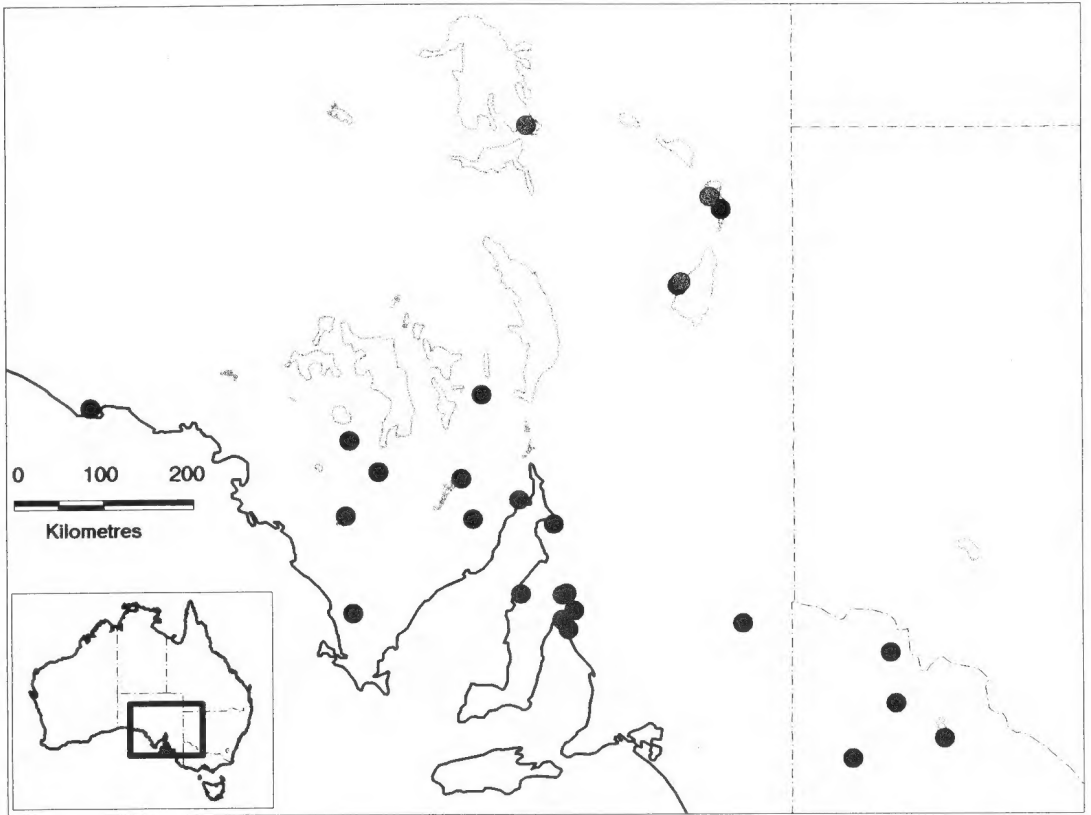


FIGURE 1. Distribution of *Pogonus hypharpagioides* Sloane, previous records (●), new records (●).

Pernatty Lagoon (sth), SA 31.6625°S 137.2375°E (SAMA). Paratypes: 5 females, same data (CBM, SAMA).

Diagnosis

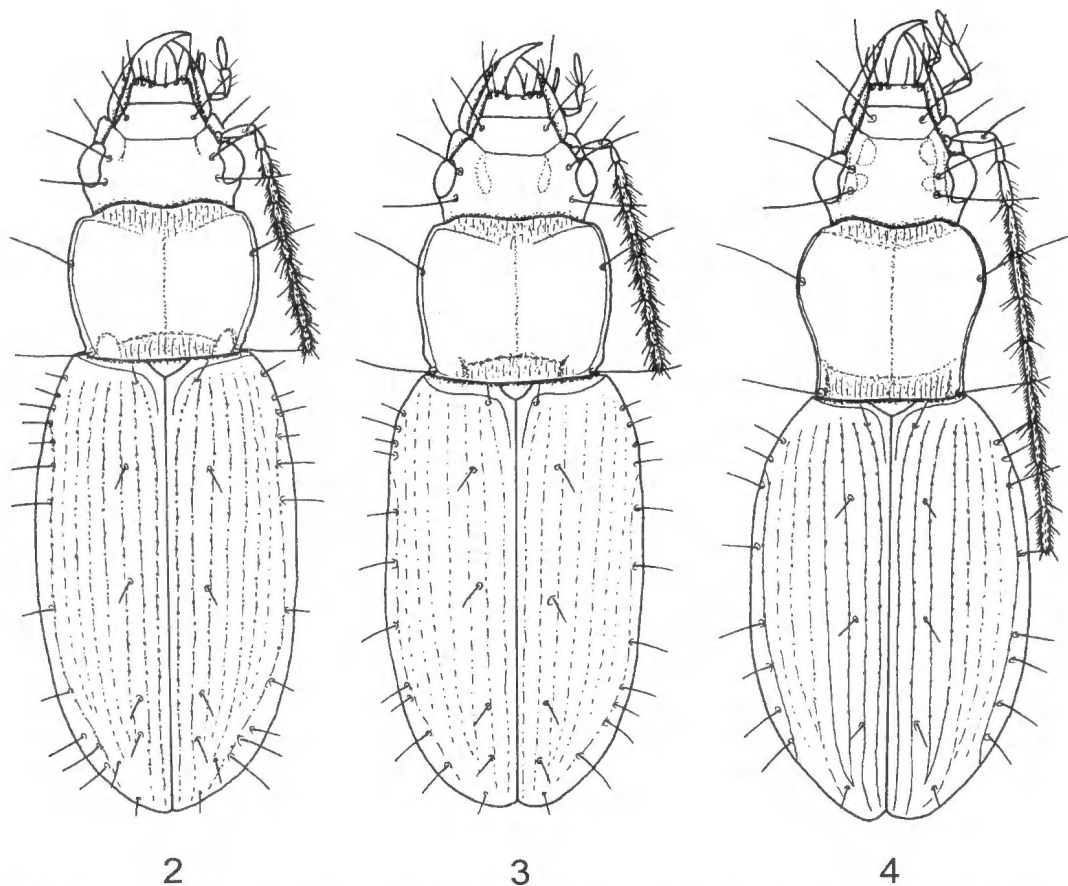
Moderately small, elongate, uniformly reddish 'syrdeniform' species, distinguished from related species mainly by its convex elytra with distinct microreticulation and markedly convex intervals, and its comparatively stout legs with wide metafemur and strongly depressed tibiae. Further distinguishing characters are in Tables 1 and 2.

Description

Measurements: Length: 5.6–6.2 mm; width: 1.9–2.0 mm. Ratios: Width/length of pronotum: 1.15–1.17; width base/apex of pronotum: 0.96–1.02; width of pronotum/width of head: 1.12–1.16; length/width of elytra: 1.86–1.90; width elytra/pronotum: 1.26–1.28. Elytral ratios are only based on two specimens since all are weakly sclerotised and most have their elytra opened and somewhat distorted.

Colour: All known specimens freshly hatched, hence mature colouration somewhat uncertain. Upper and lower surfaces including mouth parts, antennae, and legs yellow. Apex of mandibles dark.

Head (Fig. 2): Rather large and wide, fairly convex, slightly narrower than pronotum. Eyes rather small, bidentate, laterally not much projecting, posteriorly slightly enclosed. Labrum short and wide, apex gently emarginate. Mandibles rather elongate, apex fairly incurved. Palpi of moderate size, penultimate palpomere of labial palpus fairly slender, slightly bowed. Submentum quadrisetose, tooth of mentum wide, slightly cleft, bidentate. Lacinia with elongate spines. Clypeus and frons in middle convex, frontal furrows fairly short, sinuate, rather shallow, posteriorly ending in an irregularly shaped impression. Impressions with irregular wrinkles. Antennae short, well short of reaching base of pronotum, median antennomeres little longer than wide, sparsely pilose from middle of 3rd antennomere, more densely pilose from 5th antennomere. Surface rather glossy, impunctate,



FIGURES 2-4. Habitus. 2. *Pogonus matthewsi* sp. nov. 3. *Pogonus vicinus* sp. nov. 4. *Pogonus perovalis* sp. nov. Lengths: 5.6 mm; 6.0 mm; 5.5 mm.

microreticulation rather superficial, approximately isodiametric.

Pronotum (Fig. 2): Slightly wider than long, moderately convex, not cordiform, widest at anterior third slightly behind position of anterior lateral seta. Base about as wide as apex. Apex well produced beyond anterior angles, convex, in middle emarginate. Anterior angles very sharply rounded off, almost rectangular. Lateral border evenly convex throughout, with a very short concavity just in front of basal angles. Marginal channel narrow, border slightly upturned. Basal angles rectangular, dentiform, base convex, laterally rather oblique. Both apex and middle of base unmarginated. Anterior transverse sulcus fairly distinct, median line very shallow, attaining base though not apex, basal transverse sulcus shallow though distinct. Basal grooves circular, merging into marginal channel. Anterior lateral seta

situated in front of anterior third and of widest diameter, posterior marginal seta arising from basal angle. Both apex and base rugosely punctate-striolate. Disk very finely punctate or almost impunctate, at least laterally with more or less distinct, somewhat isodiametric microreticulation, with very faint, irregularly transverse striae, glossy.

Elytra (Fig. 2): Elongate, narrow, rather parallel, dorsally remarkably convex, widest at middle. Humeri very obtusely angulate. Lateral margin straight over most of its distance, little narrowed towards humeri, contiguous at sutural angle. Marginal channel extremely narrow, margin not explanate. All striae complete, well impressed, coarsely punctate. Eighth stria not bowed away from margin. Basal margin evenly curved into short scutellar stria medially of 1st stria. Intervals rather convex. Third interval with 4, rarely

unilaterally 3 setiferous punctures, the anterior and median ones adjacent to 3rd stria, situated about at basal third and at middle, the third and fourth ones in posterior third attached to 2nd stria. 11–12 widely spaced submarginal punctures in a more or less uninterrupted row attached to 8th stria. Scutellar pore and seta present, at base of 1st stria. Intervals impunctate, with very conspicuous, isodiametric microreticulation. Wings fully developed.

Lower surface: Prosternum not pilose. Metepisternum rather elongate, slightly more than half longer than wide at apex. Terminal sternum in male bisetose, in female quadrisetose.

Legs: Rather short and stout, metafemur comparatively stout, tibiae strongly depressed, with sparse and weak spination. Tibial spurs moderately elongate. Tarsi rather short, 1st tarsomere of metatarsus much shorter than both following tarsomeres. Metatrochanter in both sexes short, wide, a third of length of metafemur, apex obtusely rounded. Tarsomeres 1–3 of male protarsus slightly asymmetrically widened on median side, 1st tarsomere biserially squamose, 2nd tarsomere with few squamae on median border only.

Male genitalia (Fig. 5): Genital ring rather regularly triangular, little sclerotised, because the holotype is freshly hatched. Aedeagus small, short and compact, laterally depressed, slightly asymmetric, lower surface regularly though gently curved, apex rather short, obtuse at tip, slightly turned to right side. Internal sac with a coiled, circular, sclerotised plate near base, and with a distinctly denticulate, triangular fold near apex. Right paramere narrow, slightly shorter than left, with 3 elongate apical setae. Left paramere large, convexly tapering to apex, with 2 elongate and 1 short apical setae, the short one situated below the longer ones.

Female genitalia (Fig. 8): Stylocere 1 without setae at apex. Stylocere 2 elongate, curved, with 1 or 2 small ventral ensiform setae near base, and 2 (attached) nematiform setae originating from a groove near apex.

Variation: Only some variation of relative length of elytra and width of pronotum noted.

Distribution (Fig. 19)

So far recorded only from Pernatty Lagoon, slightly west of Lake Torrens, South Australia.

Habits

Specimens were collected following excavation of their burrows. They were widely distributed on

parts of the lake surface lacking a salt crust.

Etymology

The name is a patronym in honour of Eric Matthews, Curator of Coleoptera at the South Australian Museum who kindly gave access to the rich collections of pogonines.

Relationships

The species belongs to the *grossi*-complex, and it appears to be most closely related to *P. grossi* Moore and *P. vicinus* sp. nov.

Pogonus vicinus sp. nov.

(Figs 3, 6, 19)

Types

Holotype: male, P. Hudson 9 July 1997 SEG Exp. Lake Frome 30.6667°S 139.6028°E (SAMA). Paratypes: 1 male, P. Hudson Jul 1997 pit trap, Lake Frome, SA 30.6667°S 139.6028°E (CBM); 1 male, G. Medlin 18 May, 1997 Lake Frome, SA 30.6667°S 139.6028°E (SAMA).

Diagnosis

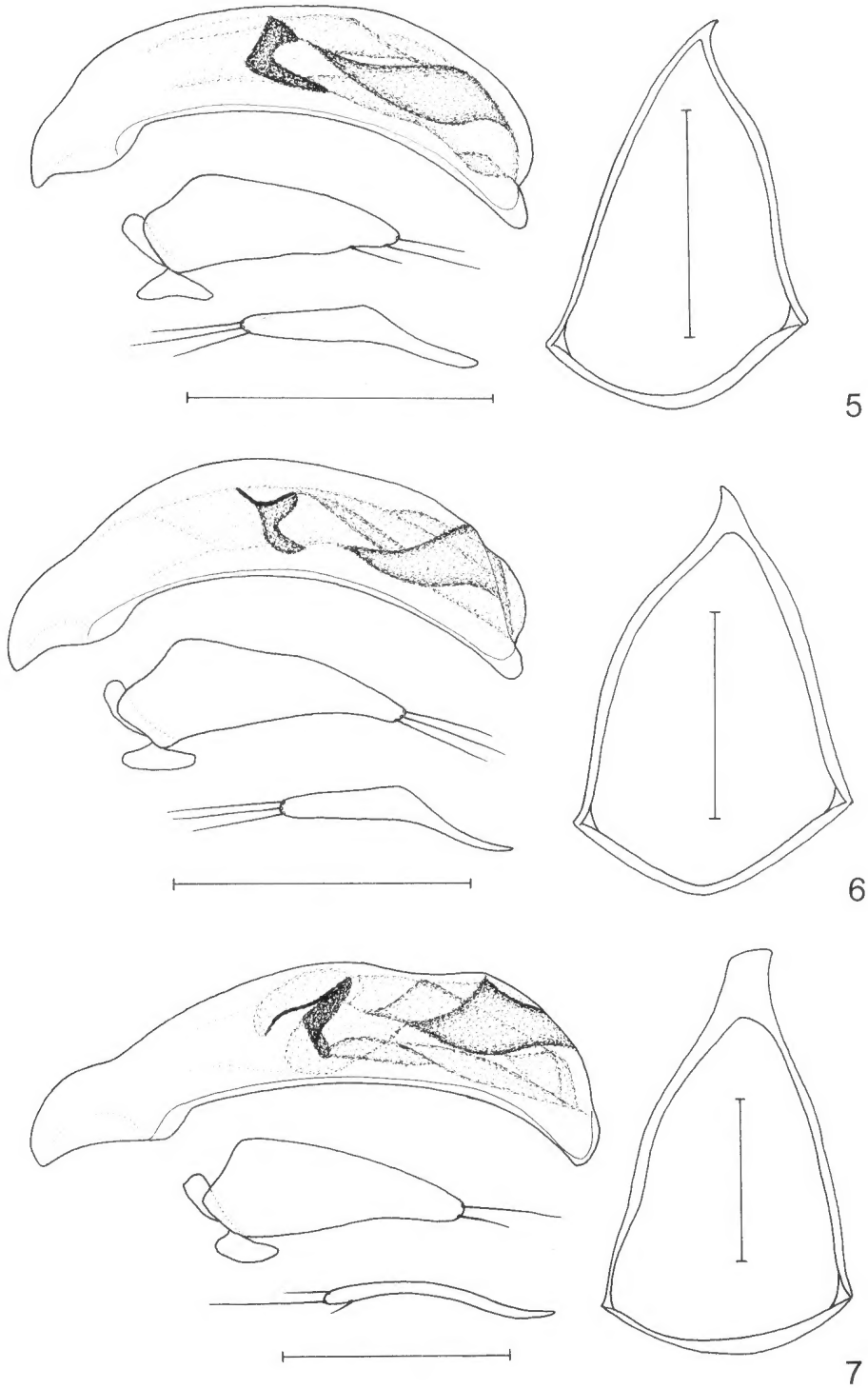
Moderately small, elongate, uniformly reddish 'syrdeniform' species, distinguished from related species mainly by its rather short and wide elytra with shallow, barely punctate striae, and the rather straight though anteriorly abrupt convex lateral margins of pronotum. Distinguishing characters are summarised in Tables 1 and 2.

Description

Measurements: Length: 5.1–6.0 mm; width: 1.85–2.10 mm. Ratios: Width/length of pronotum: 1.13–1.16; width base/apex of pronotum: 0.98–1.01; width of pronotum/width of head: 1.16–1.21; length/width of elytra: 1.72–1.77; width elytra/pronotum: 1.30–1.44.

Colour: Upper and lower surfaces including mouth parts, antennae, and legs dark yellow. Apex of mandibles dark.

Head (Fig. 3): Rather large and wide, fairly convex, slightly narrower than pronotum. Eyes rather small, fairly depressed, laterally not much projecting, posteriorly slightly enclosed. Labrum short and wide, apex gently emarginate. Mandibles moderate, apex fairly incurved. Palpi of moderate size, penultimate palpomere of labial palpus fairly slender, slightly bowed. Submentum quadrisetose, tooth of mentum wide, slightly cleft, bidentate. Lacinia with elongate spines. Clypeus and frons convex in middle, frontal furrows fairly



FIGURES 5–7. Male genitalia: Aedeagus, left side, parameres, genital ring. 5. *Pogonius matthewsi* sp. nov. 6. *Pogonius vicinus* sp. nov. 7. *Pogonius perovalis* sp. nov. Scales: 0.5 mm.

short, sinuate, fairly shallow, posteriorly ending in an irregular impression. Antennae rather short, not attaining base of pronotum, median antennomeres about a third longer than wide, sparsely pilose from middle of 3rd antennomere, more densely pilose from 5th antennomere. Surface glossy, impunctate, without microreticulation.

Pronotum (Fig. 3): Slightly wider than long, rather depressed, not cordiform, widest at anterior third slightly behind position of anterior lateral seta. Base about as wide as apex. Apex slightly produced beyond anterior angles, convex, emarginate in middle. Anterior angles very sharply rounded off, almost rectangular. Lateral border anteriorly convex or even almost oblique, then oblique and straight, just in front of basal angles incurved and forming a very small concavity. Marginal channel narrow, posteriorly slightly widened, border slightly upturned. Basal angles rectangular, very faintly dentiform, base convex, laterally rather oblique. Both apex and middle of base unmarginated. Anterior transverse sulcus fairly distinct, median line very shallow, attaining base though not apex, basal transverse sulcus moderately shallow, distinct. Basal grooves circular, merging into marginal channel. Anterior lateral seta situated in front of anterior third and point of greatest width, posterior marginal seta arising from basal angle. Apex and base rugosely punctate-striolate. Disk impunctate, without microreticulation, with very faint, irregularly transverse striae, glossy.

Elytra (Fig. 3): Comparatively short and wide for group, moderately narrow, not parallel, dorsally rather depressed, widest at middle. Humeri very obtusely angulate or almost rounded. Lateral margin gently convex over most of its distance, slightly narrowed towards humeri, contiguous at sutural angle. Marginal channel extremely narrow, margin not explanate. All striae complete, not much impressed, almost impunctate. Eighth stria not bowed away from margin. Basal margin evenly curved into short scutellar stria medially of 1st stria. Intervals depressed. Third interval with 4, rarely unilaterally 3 or 5 setiferous punctures, the anterior and median ones adjacent to 3rd stria, situated about at basal third and at middle, the third and fourth ones in posterior third attached to 2nd stria. 10–11 widely spaced submarginal punctures in a more or less interrupted row attached to 8th stria. Scutellar pore and seta present, at base of 1st stria. Intervals impunctate, with fairly superficial, isodiametric microreticulation. Wings fully developed.

Lower surface: Prosternum not pilose.

Metepisternum rather elongate, about a half longer than wide at apex. Terminal sternum in males bisetose, unknown in females.

Legs: Rather short and stout, metafemur moderately stout, tibiae fairly well depressed, with sparse and weak spination. Tibial spurs moderately elongate. Tarsi rather short, 1st tarsomere of metatarsus much shorter than both following tarsomeres. Metatrochanter in males short, wide, a third of length of metafemur, apex obtusely rounded. Tarsomeres 1–3 of male protarsus slightly asymmetrically widened on median side, 1st tarsomere biserially squamose, 2nd tarsomere with few squamae on median border only.

Male genitalia (Fig. 6): Genital ring rather regularly triangular. Aedeagus small, short and compact, laterally depressed, slightly asymmetric, lower surface regularly though gently curved, apex rather short, obtuse at tip, slightly turned to right side. Internal sac with a coiled, circular, sclerotised plate near base, and with a distinctly denticulate, triangular fold near apex. Right paramere narrow, slightly shorter than left, with 3 elongate apical setae. Left paramere large, comparatively elongate, tapering to apex, with 3 elongate apical setae.

Female genitalia: Unknown.

Variation: Only some variation of relative width of pronotum noted.

Distribution (Fig. 19)

So far recorded only from Lake Frome, southeast of Lake Eyre, South Australia.

Habits

Excavated from burrows in the lake surface and collected by pitfall trapping.

Etymology

The name refers to the strong similarity of this species to the related *P. grossi* Moore and *P. matthewsi* sp. nov.

Relationships

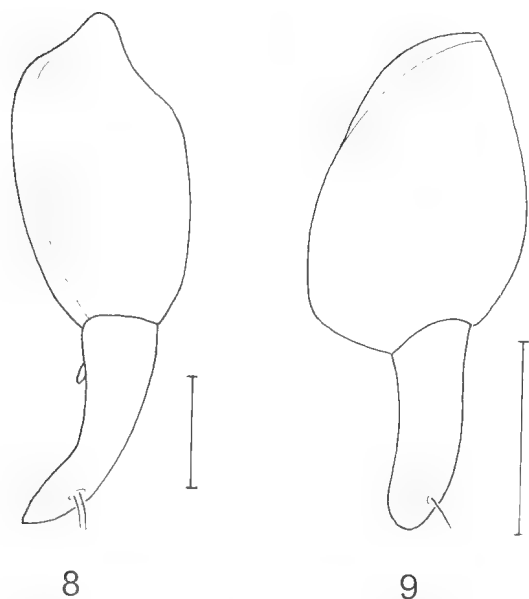
The species belongs to the *grossi*-complex, where it apparently takes a position near *P. grossi* Moore and *P. matthewsi* sp. nov.

Pogonus perovalis sp. nov.

(Figs 4, 7, 9, 10, 19)

Types

Holotype: male, P. Hudson (SEG Exp 95) Jul



FIGURES 8–9. Female stylomeres 1 and 2. 8. *Pogonus matthewsi* sp. nov. 9. *Pogonus perovalis* sp. nov. Scales: 0.1 mm.

1995 pit traps Lake Gairdner, SA 32.3014°S 135.8867°E (SAMA). Paratypes: 2 males, 1 female, same data (CBM, SAMA); 1 female, P. Hudson 3 Sep 1996 Island Lagoon, SA 31.4139°S 136.9292°E (SAMA); 1 female, Remko Leijs 30 Jun 1996 Lake Hart, SA 31.2278°S 136.3792°E (SAMA).

Diagnosis

Rather small, convex, apparently depigmented species, at once distinguished by the oval-shaped, convex elytra, convex, rather cordiform pronotum, and elongate antennae.

Description

Measurements: Length: 4.35–5.70 mm; width: 1.60–2.10 mm. Ratios: Width/length of pronotum: 1.03–1.12; width base/apex of pronotum: 0.88–0.96; width of pronotum/width of head: 1.10–1.18; length/width of elytra: 1.49–1.53; width elytra/pronotum: 1.49–1.56. Elytral ratios are only based on a few specimens since all are weakly sclerotised and most have their elytra opened and somewhat distorted.

Colour: Apparently depigmented, though all known specimens freshly hatched, hence colouration somewhat uncertain. All specimens very light yellowish. Only apex of mandibles dark.

Head (Fig. 4): Fairly large, rather depressed, slightly narrower than pronotum. Eyes large, rather convex, laterally well projecting, posteriorly not enclosed. Labrum short and wide, apex straight. Mandibles very elongate, somewhat decussate, apex incurved. Palpi elongate, apical palpomeres somewhat incised, slightly subulate. Penultimate palpomere of labial palpus slender, slightly bowed. Submentum bisetose, tooth of mentum wide, slightly cleft, bidentate. Lacinia with elongate spines. Clypeus and frons convex in middle, frontal furrows fairly elongate, rather sinuate, fairly shallow, at posterior end forming an irregular impression. Irregular wrinkles within and between impressions. Antennae very elongate, surpassing base of pronotum by almost 4 antennomeres, median antennomeres > 3 x as long as wide, pilose from middle of 3rd antennomere. Surface glossy, impunctate, without any microreticulation.

Pronotum (Fig. 4): Slightly wider than long, convex, rather cordiform, widest at anterior third approximately at position of anterior lateral seta. Base slightly narrower than apex. Apex produced beyond anterior angles, feebly convex. Anterior angles sharply rounded off. Lateral border evenly convex in anterior two thirds, then gently concave to basal angles. Marginal channel extremely narrow, border slightly upturned, forming a sharp edge. Basal angles rectangular, base slightly convex. Apex and base unmarginated. Anterior transverse sulcus barely indicated, median line very shallow, attaining base though not apex, basal transverse sulcus very shallow. Basal grooves shallow, circular, merging into marginal channel. Anterior lateral seta situated at anterior third, at point of greatest width, posterior marginal seta arising from basal angle. Both apex and base rugosely punctate-striolate. Disk impunctate and without microreticulation, highly glossy, with some very faint, transverse striae.

Elytra (Fig. 4): Short, markedly oval-shaped, convex, widest at or slightly behind middle. Humeri angulate, more or less rectangular. Lateral margin evenly convex throughout. Marginal channel narrow, margin not explanate. All striae complete, well impressed, punctate. Eighth stria originating at basal fifth, slightly bowed away from margin. Basal margin evenly curved into short scutellar stria medially of 1st stria. Intervals depressed to very feebly convex. Third interval with 3 setiferous punctures, the anterior and median ones adjacent to 3rd stria, situated at about basal third and at middle, the third puncture in posterior third attached to 2nd stria. Nine, rarely 10

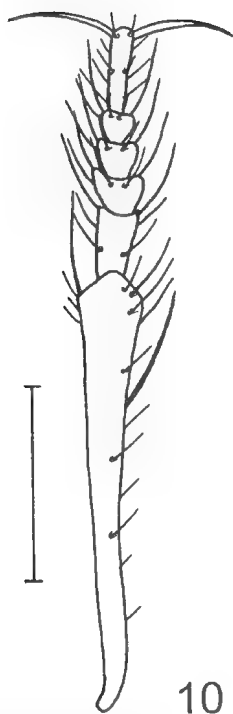


FIGURE 10. *Pogonus perovalis* sp. nov. Right protibia and tarsus, dorsolateral view.

widely spaced submarginal punctures in an uninterrupted row attached to 8th stria. Scutellar pore and seta present, at base of 1st stria. Intervals impunctate, though with very distinct, absolutely isodiametric microreticulation. Wings absent.

Lower surface: Prosternum not pilose. Metepisternum very short, shorter than wide at apex. Terminal sternum in male bisetose, in female quadrisetose.

Legs (Fig. 10): Remarkably slender and elongate, especially femora and tibiae. Tibiae not at all depressed, almost circular, with sparse and weak spination. All tibial spurs elongate. Tarsi rather short, 1st tarsomere of metatarsus shorter than both following tarsomeres. Metatrochanter in both sexes short, wide, a quarter of length of metafemur, apex obtusely rounded. Tarsomeres 1–3 of male protarsus slightly asymmetrically widened on median side, 1st tarsomere biserially squamose, 2nd tarsomere with few squamae on median border only.

Male genitalia (Fig. 7): Genital ring rather regularly triangular. Aedeagus comparatively large, fairly elongate, laterally depressed, slightly asymmetric, lower surface almost straight, in apical third markedly concave. Apex laterally very

depressed, scuriform, slightly turned to right side. Internal sac with a coiled, circular, sclerotised plate near base, and with a distinctly denticulate, triangular fold near apex. Right paramere very slender and elongate, slightly shorter than left, with one very elongate and two shorter apical setae, the elongate situated in middle. Left paramere large, comparatively elongate, tapering to apex, with 1 very elongate apical seta and a short, delicate seta below.

Female genitalia (Fig. 9): Stylomere 1 apparently without setae at apex. Stylomere 2 moderately elongate, barely curved, with wide, obtuse apex, without ventral ensiform setae, with 2 (attached) nematiform setae originating from a groove very close to apex.

Variation: Apart from some differences in size, little variation noted.

Distribution (Fig. 19)

Recorded from Lake Gairdner, Island Lagoon, and Lake Hart, all South Australia.

Habits

Collected in pitfall traps on the lake surface.

Etymology

The name refers to the markedly ovate elytra of this flightless species.

Relationships

Phylogenetically rather isolated species, but may be remotely related to the *P. grossi* species complex.

Syrdenoidius gen. nov.

Type species: *Syrdenoidius spinipes* sp. nov., by monotypy.

Diagnosis

Genus of subfamily Pogoninae. In many respects highly similar to the Palearctic genus *Syrdenus* Chaudoir, e.g. narrow, elongate, depressed body shape; absence of microreticulation on elytra; markedly angulate, even dentate humeri; wide 9th elytral interval; short, quadrate antennomeres. However, there are some striking peculiarities in *Syrdenoidius*: asetose prosternum; presence of several rows of remarkably elongate spines on all tibiae (particularly conspicuous on protibia), that occupy almost the whole length of the tibiae; prolongation of 8th elytral stria to humerus; absence of scutellar

striole and pore; absence of hind wings, and quadrate metepisternum; very elongate, forceps-like mandibles; very unusual female genitalia with extremely short, straight stylocere 2.

Etymology

The name refers to the strong similarity in external morphology to the genus *Syrdenus*.

Relationships

Whereas the similarity of some characters in *Syrdenus* and *Syrdenoidius* is probably coincidental, several could point to a closer relationship of both genera. This is especially true for the wide 9th elytral interval that bears on its median margin the marginal pores and setae that are, therefore, far removed from the lateral margin of the elytra. On the other hand, elongate, depressed body shape is an adaptation common within several pogonine genera, not only in *Syrdenus*, but also in *Pogonus* proper and in *Pogonistes*. We think that the genus *Syrdenoidius* is a highly isolated one though it possibly has closest affinities with *Syrdenus*. Whilst *Syrdenus* is so far decidedly a Palaearctic genus there is, however, an as yet undescribed species known from West Bengal, northeastern India, that demonstrates that the genus has a wider distribution than commonly believed. If the genus *Syrdenus* is a relict of the former Tethys fauna, then a relationship with the fauna of western and northwestern Australia might well be possible since it has been argued that this area formerly had contact with the Tethys or was even part of its southern shore (Eric Matthews, 1998, pers. com.). This question may be settled in the future by more intensive sampling along the coast and on the inland lakes of Western Australia.

Syrdenoidius spinipes sp. nov. (Figs 11–19)

Types

Holotype: male, S. AUST. L. Gairdner 32°07'S 135°53'E 14 July 95 P. Hudson (SAMA). Paratypes: 6 males, 13 females, same data (ANIC, CBM, SAMA); 1 female, P. Hudson 14 July 1995 SEG Exp. 95 Lake Gairdner 32°07'47''S 135°53'19''E (SAMA).

Diagnosis

Medium-sized, very elongate, narrow, depressed, depigmented species with large, convex head, large though depressed eyes, very

elongate mandibles, almost regularly trapezoidal pronotum that is widest at apex, non-microreticulate surface, and remarkably spinose tibiae.

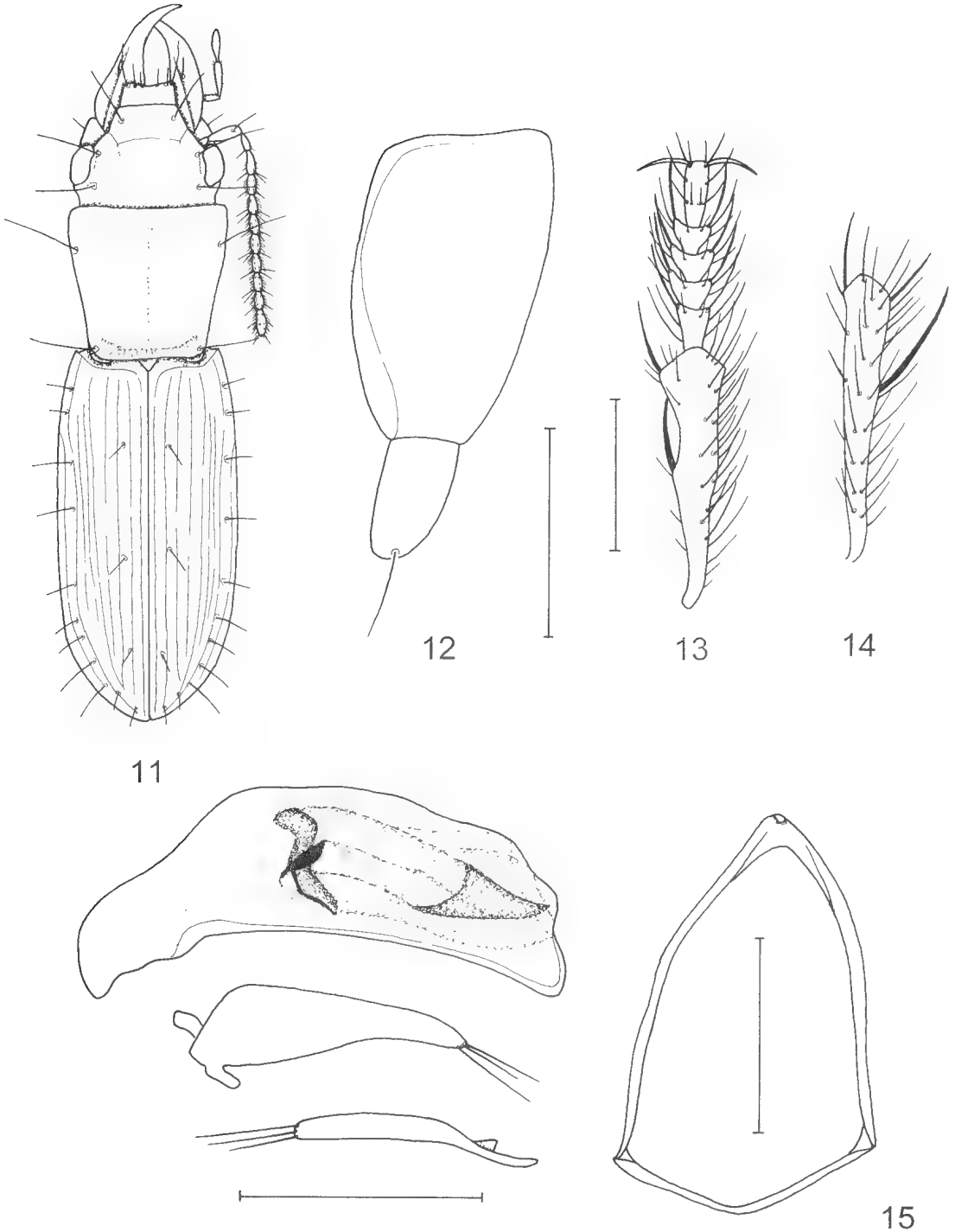
Description

Measurements: Length: 5.4–6.3 mm; width: 1.50–1.65 mm. Ratios: Width/length of pronotum: 1.03–1.08; width base/apex of pronotum: 0.73–0.77; width of pronotum/width of head: 1.04–1.07; length/width of elytra: 2.06–2.12; width elytra/pronotum: 1.12–1.16.

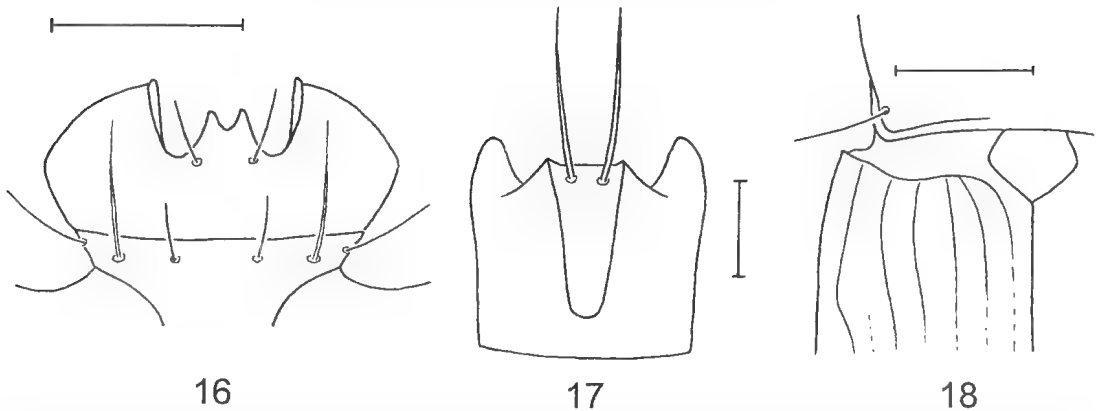
Colour: Upper and lower surface, including mouth parts, antennae, and legs light reddish, elytra very slightly lighter. Apex of mandibles darker.

Head (Figs 11, 16–18): Large, convex, slightly narrower than pronotum. Eyes large though remarkably depressed, laterally barely projecting, posteriorly not enclosed. Lower rim of eye forming a sharp edge that slightly surpasses the eye laterally. Labrum short and wide, apex fairly emarginate. Mandibles very elongate, somewhat decussate, apex strongly incurved. Palpi elongate, apical palpomeres somewhat incised, slightly subulate. Penultimate palpomere of labial palpus very slender, slightly bowed. Submentum sexsetose, tooth of mentum wide, deeply cleft, markedly bidentate (Fig. 16). Lacinia with very elongate spines. Ligula bisetose, paraglossae slightly surpassing glossa (Fig. 17). Clypeus and frons convex in middle, frontal furrows elongate, slightly sinuate, beginning on clypeus. Frons behind frontal furrows with a wide, circular, shallow impression on either side, irregular wrinkles between impressions. Antennae short, wide, not attaining base of pronotum, median antennomeres almost as wide as long, sparsely pilose from middle of 3rd antennomere, more densely pilose from 5th antennomere. Surface glossy, impunctate, without any microreticulation.

Pronotum (Figs 11, 18): Barely wider than long, remarkably trapezoidal, widest at apex. Surface moderately convex. Apex little produced beyond anterior angles, in middle with very shallow, triangular excision. Anterior angles broadly rounded. Lateral margin almost straight, oblique, slightly rounded only near apex, faintly incurved towards base. Border somewhat irregular, bearing several slight notches. Basal angles obtusely rounded, base almost straight. Marginal channel extremely narrow, margin forming a fairly sharp ridge. Apex unmarginated, base coarsely marginated, margin narrowly surrounding basal angles and meeting lower margin of epipleura, this margin



FIGURES 11–15. *Sydenoidius spinipes* gen. nov., sp. nov. 11. Habitus. Length 5.6mm. 12. Female stylomeres 1 and 2. Scale 0.1mm. 13. Right protibia and tarsus, dorsal view. 14. right protibia, dorsolateral view. Scale: 0.5 mm. 15. Male genitalia: Aedeagus, left side, parameres, genital ring. Scale 0.5mm.



FIGURES 16–18. *Syrdenoidius spinipes* gen. nov. sp. nov. 16. Mentum and submentum, ventral view. Scale: 0.5 mm 17. Ligula, ventral view. Scale: 0.1 mm. 18. Base of left elytron. Scale 0.5 mm.

sometimes even visible from above (Fig. 18). Anterior transverse sulcus barely indicated, median line very shallow, deepened near base, attaining apex and base. Basal transverse sulcus shallow though distinct. Base coarsely striolate, basal grooves rather shallow, irregular. Anterior marginal seta inserted at anterior fourth, posterior seta situated just in front of basal angle, anterior and posterior setae slightly removed from margin. Disk impunctate and without any microreticulation, highly glossy, though laterally with some transverse striolations.

Elytra (Figs 11, 18): Very narrow and elongate, parallel-sided, markedly depressed. Humeri very sharply projecting, markedly angulate. Lateral margin gently oblique or slightly convex in basal fourth, then parallel, only in apical fourth convex again. Marginal channel narrow throughout. Apical angles broadly rounded, apex in middle slightly incised. No internal plica visible from outside. Striae complete, deep, not punctate, but somewhat irregular, sometimes interrupted or with anastomoses. Eighth stria bowed away from margin in anterior fourth, laterally leaving a wide space, though anteriorly attaining humerus. Basal margin evenly curved into 1st stria, no scutellar stria present. Scutellar pore and seta absent. Intervals convex, though their surface rather uneven. Third interval with 3 setiferous punctures adjoining 3rd stria, the first situated in anterior third, the second in middle, the third in apical third, but their position rather variable. Submarginal punctures far removed from margin, adjoining lateral margin of 8th stria, consisting of 4 punctures in anterior group and 6 punctures in posterior group, with a wide space between them.

Also with 1 puncture at end of 5th interval and 2nd interval. Surface impunctate, without microreticulation, highly glossy. Wings almost completely reduced.

Lower surface: Prosternum not pilose. Metepisternum short, barely longer than wide at apex. Terminal sternum in male bisetose, in female quadrisetose.

Legs (Figs 13, 14): Moderately elongate. Protibia and mesotibia with 4 rows of remarkably stout and elongate spines all along dorsal, lateral, and latero-ventral surfaces. Metatibia less spinose. Apical tibial spurs of protibia and mesotibia remarkably elongate, much longer than 1st tarsomere. Tarsi rather short, 1st tarsomere of metatarsus shorter than both following tarsomeres. Tarsi remarkably hirsute. Tarsomeres 1–3 of male protarsus slightly asymmetrically widened on median side, 1st and 2nd tarsomeres with few squamae on median border. Metatrochanter in both sexes less than half as long as metafemur, obtuse at apex.

Male genitalia (Fig. 15): Genital ring wide, in basal half almost quadrangular, apically regularly triangular, rather symmetric. Aedeagus short and very compact, laterally depressed, slightly asymmetric, lower surface barely curved, apex very short, obtuse, barely turned laterally. Internal sac with a complexly coiled, in parts heavily sclerotised plate near base, and with a distinctly denticulate, triangular fold near apex. Right paramere moderately narrow, about a third shorter than left, with 3 elongate apical setae. Left paramere elongate, rather slender, abruptly narrowed to the downcurved apex, with 3 elongate apical setae.

Female genitalia (Fig. 12): Stylocere 1 apparently without setae at apex. Stylocere 2 very short, straight, almost quadrate, with wide, convex apex, without ensiform setae, though with an elongate nematiform seta arising from apex.

Variation: Very little variation noted.

Distribution (Fig. 19)

Only recorded from Lake Gairdner, South Australia.

Habits

Excavated from burrows in the lake surface.

Etymology

The name refers to the remarkably spinose tibiae of this species.

KEY TO THE GENERA OF AUSTRALIAN POGONINAE

- 1. — Elytra without microreticulation; humerus sharply angulate (Figs 11, 18); protibia with several rows of elongate spines on dorsal and lateral surfaces that occupy almost the whole length (Figs 13, 14); pronotum remarkably trapezoidal, widest at anterior angles (Fig. 4). Lake Gairdner, SA *Syrdenoidius* gen. nov. (only *S. spinipes* sp. nov.)

- 2. — Elytra with distinct microreticulation; humerus not so angulate (Figs 2-4); protibia with a short row of moderate spines on lateral surface only (Fig. 10); pronotum differently shaped, widest far behind anterior angles (Figs 2-4). Widely distributed in Australia *Pogonus* Dejean

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS *POGONUS* DEJEAN

- 1. — Body completely metallic green or black 2
- Body entirely or in parts testaceous 5
- 2. — Colour shining black; punctures of elytra very coarse, microreticulation inconspicuous. Northeastern Queensland, coastal and inland *nigrescens* Baehr
- Colour greenish metallic; punctures of elytra finer, microreticulation conspicuous. Southern half of Australia 3
- 3. — Sixth and 7th striae almost similar to inner 5 striae; flightless; elytral margins ovate. Lake Yindarlgooda, Western Australia *fennelli* Hudson
- Sixth and 7th striae less marked than 5

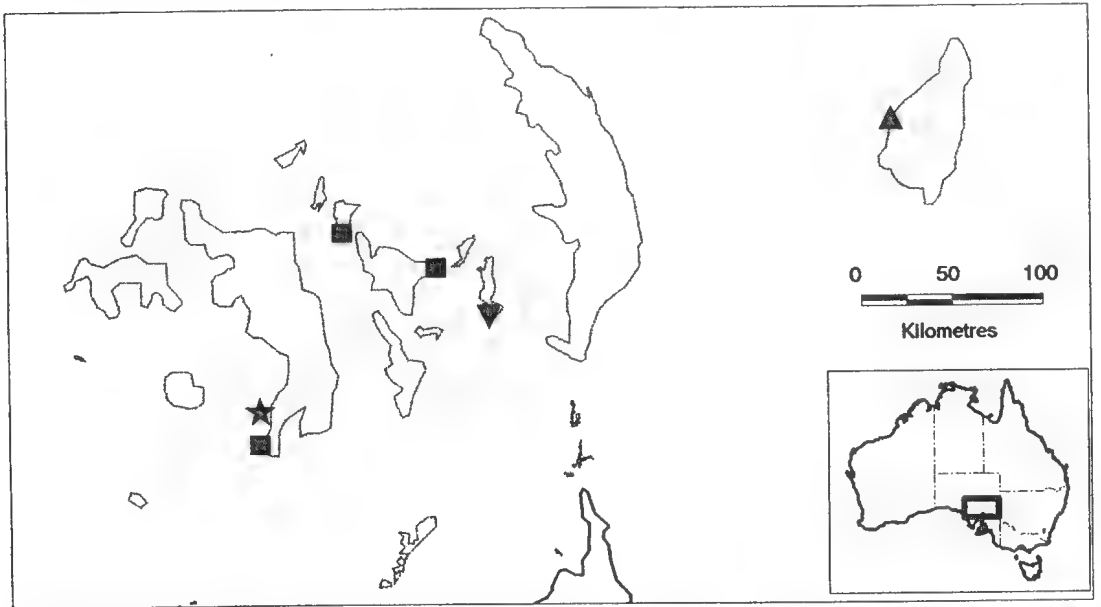


FIGURE 19. Distribution of *Pogonus matthewsi* sp. nov. (▼), *P. vicinus* sp. nov. (▲), *P. perovalis* sp. nov. (■), *Syrdenoidius spinipes* gen. nov., sp. nov. (★).

- inner striae; fully winged; elytral margins more parallel sided 4
4. — Smaller (body length 6.3–6.8 mm), body narrower, more convex; pronotum markedly sinuate in front of the acute basal angles, these being 90° or less; submarginal basal ridge of pronotum scarcely indicated. Southern Australia from Western Australia to Victoria along coast *australis* Chaudoir
- Larger (body length 7.5–8.5 mm), body wider, less convex; pronotum less sinuate, basal angles more obtuse, these being c. 100°; submarginal basal ridge of pronotum conspicuous. Coastal and inland from southern half of Western Australia to southeastern Queensland *cardiotrachelus* Chaudoir
5. — Bicoloured, head and pronotum distinctly darker than elytra 6
- Completely testaceous or light reddish, head and pronotum not perceptibly darker than elytra (variable species under both couplets) 7
6. — Large, convex species (body length 9–11 mm); pronotum not lobate, distinctly sinuate in front of basal angles. Northern Australia from northwestern Queensland to the Kimberleys, coastal and along tidal rivers *variabilis* Moore
- Small, depressed species (body length c. 6.5 mm); pronotum lobate, barely sinuate in front of basal angles. Inland saline habitats in Western Australia and South Australia *zietzi* Sloane
7. — Large species (body length >9 mm); either pronotum distinctly sinuate in front of basal angles and base about as wide as apex, or pronotum rather quadrate with characteristically bisinuate base, and elytra wide, oval-shaped, and depressed with wide, explanate lateral margin. Northern Australia from northwestern Queensland to Exmouth Gulf, coastal and along tidal rivers 8
- Smaller species (body length <8.5 mm); pronotum distinctly sinuate or not in front of basal angles; but when distinctly sinuate, then base markedly narrower than apex; when not sinuate, then elytra not wide, oval-shaped, and depressed; and with narrower, not explanate lateral margin. Inland in southern half of Australia 9
8. — Pronotum distinctly sinuate in front of basal angles, lateral margin not explanate at base; eyes convex, laterally markedly protruding; elytra less wide and depressed, lateral margin not explanate, striation deeper and more complete, striae distinctly punctate. Northern Australia from northwestern Queensland to the Kimberleys *variabilis* Moore
- Pronotum rather quadrate, lateral margin conspicuously explanate at base; eyes depressed, laterally little protruded; elytra wide and depressed, lateral margin explanate, striation shallow and laterally incomplete, striae more finely punctate. Coast of northwestern Australia south of Great Sandy Desert *sumlini* Baehr
9. — Pronotum distinctly sinuate in front of basal angles and base markedly narrower than apex; left paramere with 2 apical setae, right paramere with a single apical seta. South Australia, Lake Eyre Basin ..
..... *gilesi* Moore
- Pronotum either not distinctly sinuate in front of basal angles or base about as wide as apex; left paramere with 3, right paramere with 2 or 3 apical setae 10
10. — Large, convex species (body length 7.2–8.4 mm); head large, pronotum laterally markedly convex. South Australia, northwestern Victoria
..... *hypharpagioides* Sloane
- Smaller, more depressed species (body length <6.5 mm); head smaller, pronotum laterally less convex 11
11. — Pronotum rather quadrate, lateral margin evenly curved from apex to base, widest in middle; elytral striae shallow, only 3 inner striae distinct. Interior of Western Australia *diplochaetoides* Baehr
- Pronotum more narrowed to base than to apex, widest in anterior third, lateral margin not so evenly curved; elytral striae deeper, at least 5 inner striae distinct. South Australia 12
12. — Elytra laterally and dorsally convex, oviform; pronotum narrow, convex, with elongate situation in front of basal angles (Fig. 4); antenna elongate, median antennomeres >3 x as long as wide. Lake Gairdner, Island Lagoon, Lake Hart
..... *perovalis* sp. nov.
- Elytra elongate, parallel, dorsally

- depressed; pronotum wide, depressed, with at most a short sinuation in front of basal angles (Figs 2, 3); antenna short, median antennomeres $<1.5 \times$ as long as wide 13
13. — Smaller species (body length 4.1–4.9 mm); lateral margin of pronotum straight or slightly concave in front of base, basal angle almost 90° , distinctly projecting. Lake Gairdner, Island Lagoon, Lake Hart *saskiae* Baehr
- Larger species (body length 5.2–6.4 mm); lateral margin of pronotum convex to base, basal angle obtuse, or dentiform 14
14. — Elytra rather convex, intervals remarkably convex, microreticulation conspicuous. Pernatty Lagoon *matthewsi* sp. nov.
- Elytra rather depressed, intervals but slightly convex, microreticulation distinct though not conspicuous 15
15. — Lateral margin of pronotum evenly convex, basal angle not dentiform; elytra longer, striae rather deep, distinctly punctate. Lake Eyre *grossi* Moore
- Lateral margin of pronotum rather straight, in anterior third suddenly convex, basal angle dentiform; elytra shorter, striae rather shallow, barely punctate. Lake Frome *vicinus* sp. nov.

REMARKS

The collections included within this paper have been made from lakes ranging up in size from approximately 0.3 km^2 ('Artaming Lake', south of Lake Acraman) to large systems such as Lake Torrens, Lake Frome, Lake Gairdner, and Lake Tyrell. Usually the collections were made when the lakes were devoid of surface water. The beetles were usually collected during the day by excavating their burrows, the location of which was indicated by a small mound of mud on the lake surface. The beetles occupy a large part of the dry lake surface that is free of salt crust. Some collections have also been made using pitfall traps, even on surfaces covered with a thin salt crust and some specimens were detected while running on the surface at night.

From excavated specimens and pit-trapping at least two species are known to occur on Lake Gairdner, *Syrdenoidius spinipes* and *P. perovalis*. According to Moore (1977), at the shore of Lake

Eyre three species have been also found together at light, namely *P. hypharpagioides*, *P. gilesi*, and *P. grossi*. However, as on Lake Gairdner, the three species represent rather different life style types, namely a large, bulky one (*P. hypharpagioides*), a medium sized one (*P. gilesi*, comparable to *P. perovalis*), and an elongate, depressed one (*P. grossi*, comparable to *Syrdenoidius spinipes*). Hence, the species obviously occupy a special niche, at least with respect to food preferences which is demonstrated by their different head sizes and mandible lengths and shapes.

If this and other recent papers on the Australian pogonine fauna are any indication then it is most likely that there are numerous other taxa awaiting collection and description. With the existence of flightless taxa there is an increased likelihood that some species will be highly endemic. Clearly a systematic survey of the salt lake fauna of southern Australia is warranted, in the first instance to establish the extent of the Australian fauna and secondly for conservation purposes since many salt lakes, especially those in Western Australia, are sites of intense mining activity.

The 'island-like' nature of the Australian salt lake habitats and the range in their size and degree of geographic isolation make studies of their fauna particularly interesting from an evolutionary and genetic perspective (e.g. see Hudson and Adams 1996). Desender and Serrano (1999) have highlighted the value of using electrophoresis techniques in the study of variation in Atlantic and Mediterranean European populations of *Pogonus chalceus* and similar such studies could provide valuable insight to the Australian pogonines.

Wing atrophy and flightlessness in beetles has been documented by numerous authors (Kavanaugh 1985, Roff 1990, and references therein). In pogonines outside Australia, full wing atrophy is only known in the Californian *Thalassotrechus barbarae* (Horn), an intertidal species which is outstanding also in other morphological characters. Principally, all other known pogonines possess fully developed wings and are capable of flight. However, reduction in wing size and lack of functional flight musculature is known in some *Pogonus chalceus* populations (Desender 1989, pers. com. 1999), though the Mediterranean populations of that species are capable of flight (Ravizza 1972). Hence, from the viewpoint of wing development the Australian pogonine fauna seems to be highly unusual, because full reduction of wings is known in three rather different Australian groups, the

genus *Syrdenoidius* and the fully pigmented and depigmented species groups of the genus *Pogonus*.

It should be stressed, however, that in Australia at least, there is a clear difference between species inhabiting saline coastal habitats and those that exclusively live on inland salt lakes. Unlike in the Mediterranean, for example, the Australian sea shores are inhabited only by quite large, convex species of normal 'pogoniform' habitus (*P. australis*, *P. cardiotrachelus*, *P. nigrescens*, *P. sumlini*, *P. variabilis*), most of which are pigmented, whereas elongate, depressed, depigmented 'syrdeniform' species are completely absent from these environments. These latter species occur in saline inland environments together with pigmented species (*P. cardiotrachelus*, *P. fennelli*), and convex, medium-sized or large, either depigmented or partly depigmented species (*P. gilesi*, *P. hypharpagioides*, *P. zietzi*). Flightless species have been found only in inland environments (*P. fennelli*, *P. perovalis*, *Syrdenoidius spinipes*).

If we argue that the pigmented 'pogoniform' species, from the viewpoint of phylogeny, are most

plesiotypic, and the depigmented 'syrdeniform' species most apotypic, then the interior saline environment in Australia has a very diverse, highly evolved pogonine fauna, which is evidence of a long term history of the fauna. In the rich pogonine fauna of the Mediterranean region which likewise includes normal 'pogoniform' species and 'syrdeniform' species the latter occur only at the sea shore. The history of the Australian pogonine fauna thus is strikingly different and once more it demonstrates the island-like structure of the Australian inland saline habitats that must have been isolated for a long period.

ACKNOWLEDGMENTS

Lakes Gairdner and Frome are within the SA National Parks and Reserves system and permits Z23651-01 and Z23803-02 were issued for the collections made from these lakes. The Scientific Expedition Group is thanked for the opportunity to be involved in field trips to the Gawler Ranges and Balcanoona Station. Paul Fennell, Remko Leijts and Jayne Skinner are thanked for their collecting efforts. We thank Eric Matthews (SAMA) for the loan of most of the material.

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APPENDIX

Checklist of the recorded species of Pogoninae from Australia

<i>Pogonus australis</i> Chaudoir	s.WA, VIC
<i>Pogonus cardiotrachelus</i> Chaudoir	s.WA, VIC, s.QLD
<i>Pogonus diplochaetoides</i> Baehr	c.WA
<i>Pogonus fenelli</i> Hudson	s.WA
<i>Pogonus gilesi</i> Moore	c.SA
<i>Pogonus grossi</i> Moore	c.SA
<i>Pogonus hypharpagioides</i> Sloane	c.SA, w.VIC
<i>Pogonus matthewsi</i> sp. nov.	c.SA
<i>Pogonus nigrescens</i> Baehr	ne.QLD
<i>Pogonus perovalis</i> sp. nov.	c.SA
<i>Pogonus saskiae</i> Baehr	c.SA
<i>Pogonus sumlini</i> Baehr	n.WA
<i>Pogonus variabilis</i> Moore	n.QLD, n.NT, n.WA
<i>Pogonus vicinus</i> sp. nov.	c.SA
<i>Pogonus zietzi</i> Sloane	c.WA, c.SA
<i>Syrdenoidius spinipes</i> gen. nov., sp. nov.	c.SA